Lat 40.75505 Lon -121.62398

Forest Health Protection

Pacific Southwest Region
Northeastern California Shared Service Area

Date: August 25, 2015
File Code: 3420

To: District Ranger, Hat Creek Ranger District, Lassen National Forest

Subject: Heterobasidion root disease in the Whittington Project (FHP Report NE15-09)

On August 6, 2015, Bill Woodruff, Forest Health Protection (FHP) Plant Pathologist, Naomi Brown, Timber Sales Prep Tech and Kendra Fallon, Forester examined a mixed conifer stand in the Whittington project just south southwest of Burney Mtn. The purpose of the exam was to evaluate Heterobasidion root disease and recommend treatment.

The stand has many widely spaced old growth conifers (sugar pine, ponderosa pine, incense cedar and white fir; listed in order of decreasing numbers); which escaped a large wildfire which occurred about a century ago. The understory is stocked with mature overcrowded white fir trees (Figure 1). Many downed and decaying white fir boles lay decaying (Figure 1) on the forest floor. Sizes of the fallen white fir range from about 10" to 16" dbh. The stand is bordered on the west by

Figure 1. Overstocked mature white fir (L) and downed white fir (R).

a recently logged private forest and on the east by FS forest which was windrowed and planted about 50 years ago to replace the brush which grew following the fire. The Jeffrey pine growing in this plantation are approximately 50' tall.

Observations

After several hours of searching, stumps containing fruiting bodies of *Heterobasidion spp.* could not be found in the Whittington stand. However, there is little doubt that Heterobasidion root disease is present in the white fir; because many of the wind-thrown white fir trees had butt and root decay indicative of this disease. The fungal species of this disease known to infect white fir is *H. occidentale*.

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The decay in white fir caused by this fungus delaminates the root and butt wood at the growth rings (Figure 2).

Figure 2. Delaminated decay in white fir roots, a sign of Heterobasidion root disease

When the roots of standing white fir trees are heavily infected with *H. occidentale*, tree height growth declines and the trees have short growth leaders. Premature shortening of leader growth in white fir results in trees with prematurely rounded/flattened tops (Figure 3). Some of the young mature white fir trees in the Whittington stand had rounded slow-growing tops instead of pointed tops characteristic of fast-growing and healthy white fir trees; meaning that the roots may be infect-ed with *H. occidentale.*

Most of the white fir trees appear healthy in the Whittington stand and only occasional trees appear to be infected with *H. occidentale.* Ms. Brown reported finding at least one small (less than 1 acre in size) root disease center in the stand on a previous visit. In addition to a small root disease problem, much of the Whittington stand is overstocked with white fir trees. Almost all the old growth conifers are surrounded by a dense white fir understory; which is probably robbing the overstory trees of available soil moisture needed for survival, especially during times of drought.

Figure 3. Rounded/flattened tops of white fir trees a sign that the roots may be infected with *H. occidentale.*

<u>Recommeded Action 1:</u>
<u>reduce overcrowding in white fir</u>

Mature white fir trees with roots infected with *H. occidentale* can often live indefinitely, providing they are not stressed by overcrowding caused by moisture stress, especially during drought. Since *H. occidentale* primarily infects the heartwood of mature fir trees, the outer xylem (sapwood) is left to function in moving water up the tree. However, *H. occidentale*-infected trees stressed by overcrowding grow new wood (xylem) slower, resulting in small outer growth rings throughout the tree. Slow growth of new wood in roots being decayed by *H. occidentale* creates a situation where the fungus can decay wood in a root from the inside out faster than the tree can grow new outside wood resulting

in structurally weak and poorly functioning roots; thus lowering the tree's resilience during drought to fir engraver attack.

Thinning the overcrowded white fir understory will reduce the number of stems competing for limited soil moisture resulting in more moisture per tree. This should enhance tree growth which helps makes each tree structurally strong and resistant to beetle attack, especially during drought. The heavier the thinning, within limits, the more water available for tree growth.

All whiter fir in Heterobasision root disease groups could be removed for best management of the disease. Because most of the mature white fir appear healthy and not affected by heavy *H. occidentale* infection, the freshly cut white fir stumps greater than 14 inches should be treated with a registered borate fungicide, licensed for the control of Heterobasidion root disease.

Recommeded Action 2: radial thin around old growth conifers

Most of the large old growth conifers in the Whittington stand are closely surrounded by over-stocked white fir (Figure 4). In order to increase the resilience of the crowded old growth trees, radial thinning around them is advised. Radial thinning consists of removing all understory trees at least as far as the drip lines of the overstory conifers. Radial thinning should add available soil moisture for the growth and long-term survival of the old growth conifers in addition to the extra available water provided by the thinning of the white fir.

Figure 4. Crowded old growth ponderosa pine (L). Crowded and declining old growth sugar pine (R).

If you have any questions regarding this report and/or need additional information please contact Bill Woodruff at 530-252-6680.

/s/ Bill Woodruff

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Cc: Naomi Brown

Attachment:

Heterobasidion root disease

Heterobasidion spp. is a fungus that attacks a wide variety of woody plants. All western conifer species are susceptible. Madrone (*Arbutus menziesii*), and a few brush species (*Arctostaphylos spp.* and *Artemisia tridentata*) are occasional hosts. Other hardwood species are apparently not infected. The disease has been reported on all National Forests in California, with incidence particularly high on true fir in northern California, in the eastside pine type forests, and in southern California recreation areas.

Heterobasidion root disease is one of the most important conifer diseases in Region 5. Current estimates are that the disease infests about 2 million acres of commercial forestland in California, resulting in an annual volume loss of 19 million cubic feet. Other potential impacts of the disease include: increased susceptibility of infected trees to attack by bark beetles, mortality of infected trees presently on the site, the loss of the site for future production, and depletion of vegetative cover and increased probability of tree failure and hazard in recreation areas.

During periods favorable to the fungus, fruiting bodies (conks) form in decayed stumps, under the bark of dead trees, or under the duff at the root collar. New infection centers are initiated when airborne spores produced by the conks land and grow on freshly cut stump surfaces. Infection in true fir may also occur through fire and mechanical wounds, or occasionally, through roots of stumps in the absence of surface colonization. From the infected stump surface, the fungus grows down into the roots and then spreads via root-to-root contact to adjacent live trees, resulting in the formation of large disease centers. These infection centers may continue to enlarge until they reach barriers, such as openings in the stand or groups of resistant plants. In pines, the fungus grows through root cambial tissue to the root crown where it girdles and kills the tree. In true fir and other non-resinous species, the fungus sometimes kills trees, but more frequently is confined to the heartwood and inner sapwood of the larger roots. It then eventually extends into the heartwood of the lower trunk and causes chronic decay and growth loss.

Heterobasidion root disease in western North America is caused by two species:
Heterobasidion occidentalis (also called the 'S' type) and *H. irregularis* (also called the 'P' type). These two species of *Heterobasidion* have major differences in host specificity. *H. irregularis* ('P' type) is pathogenic on ponderosa pine, Jeffrey pine, sugar pine, Coulter pine, incense cedar, western juniper, pinyon, and manzanita. *H. occidentalis* ('S' type) is pathogenic on true fir, spruce and giant sequoia. This host specificity is not apparent in isolates from stumps; with *H. occidentalis* being recovered from both pine and true fir stumps. These data suggest that infection of host trees is specific, but saprophytic colonization of stumps is not. The fungus may survive in infected roots or stumps for many years. Young conifers established near these stumps often die shortly after their roots contact infected roots in the soil.

Proper borate treatment of freshly cut conifer stumps kills *Heterobasidion spp.* spores which land on treated stumps; and prevents the spores from germinating and infecting the stumps and roots (and subsequently the roots of adjacent host conifers). USFS Region 5 requires stump treatment in recreation and administrative sites.